

shorter and thicker; compared with *unda*, Mayr., the postpetiole is wider still in proportion to its length. The shape of the pedicel, as seen from above, appears to come nearest to *batesi*, For., but both nodes are higher in profile.

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### "The Phoresy of Antherophagus."

By HORACE DONISTHORPE, F.Z.S., F.E.S., etc.

In 1919 my friend Professor W. M. Wheeler published a most interesting and able paper on the Phoresy of *Antherophagus*. The following is a resumé of this paper, together with a few notes, and additions to the facts and literature of the subject, known to me.

On August 16th, 1919, while collecting near Colebrook, Wheeler observed a worker *Bombus vagans* behaving in an erratic manner on the flowers of golden-rod. The *Bombus* repeatedly attempted to insert its proboscis into the flowers, but did not succeed because a female of *Antherophagus ochraceus*, Mels., was firmly attached by its mandibles to the right maxilla and the tongue. It did not release its hold in the cyanide jar, and Wheeler shows it in its original position in the accompanying figure to his paper. He failed to find any record of such behaviour in the American *Antherophagi* (*ochraceus*, *convexus*, and *suturalis*), but a perusal of the accounts of the European species (*nigricornis*, *silaceus*, and *pallens*) yielded a satisfactory explanation. In 1896 Lesne called attention to insects that ride on larger ones, and applied the term "phoresy" to this phenomenon, showing that it is distinguished from ectoparasitism by the fact that the portee does not feed on the porter, eventually dismounting and having no further relations with the latter. Janet, in 1897, expanded the concept, distinguishing six different categories;

(1) Cases like that of the small flies of the genus *Limosina*, which ride on the dung-beetle, *Ateuchus*, and represent phoresy in its typical form as conceived by Lesne.

(2) Cases in which the portee is conveyed to the nest of the porter, like the triungulin larvæ of certain beetles (*Sitaris*, *Meloë*, etc.), and the triungulins of the Strepsiptera.

(3) Cases like a few myrmecophilous beetles (*Thorictus*), which attach themselves to the antennæ of ants for the purpose of accompanying them on their peregrinations.

(4) Cases like the mites of the genus *Antennophorus*, which are not only carried but fed by the ant. These and the cases under (3) might be referred to ectoparasitism.

(5) Indirect phoresy, as exhibited by certain mites that cling to the surfaces of ant larvæ and pupæ, which are in turn transported by the ants.

(6) The case of ants that carry in their mandibles their own young, other members of the colony, or guests.

In 1911 Banks published some 17 cases of phoresy collected from the literature, others being recorded by Warren (1903), Braes (1917a, 1917b), and Rabaud (1917). These authors cited cases of parasitic Hymenoptera which attach themselves to the abdomens of Orthoptera, or the wings of Mantoidea, in order to be on hand to oviposit in the eggs of their porters; such cases representing a seventh category.

Lesne and Janet cited the case of *Antherophagus* (overlooked by

Banks), which attaches itself to the legs, mouthparts, or antennæ of humble-bees, for the purpose of being transported to their nests. The earliest observation of this habit was made by the British Coleopterist, T. J. Bold, in 1856. He wrote: "Mr. Smith, in his admirable work on British bees, records the finding of *Antherophagus glaber* in the nest of *Bombus derhamellus*. This season I met with an instance of the manner in which such insects may be transported thither. When hunting *Bombi* in September last, the peculiar motions of a neuter of *B. sylvarum* attracted my attention; it was clinging to a thistlehead, and wriggling and twisting its legs about in all directions. On getting hold of it I found that a large specimen of *Antherophagus nigricornis* had seized the tarsus of a hind leg between its jaws, and was holding on like grim death. I put both into my bottle, and the *Antherophagus* retained its hold until both were killed by the fumes of the laurel."

Redtenbacher (1858) recorded taking three *A. nigricornis*, together with a number of its larvæ, in a humble-bee's nest. In 1863 Carus and Gerstaecker published the following note on the genus *Antherophagus*: "The species live on flowers, attach themselves to humble-bees, and permit the latter to transport them to their nests, probably for the purpose of oviposition; at any rate, small larvæ resembling those of *Cryptophagus* are sometimes found among the beetles in the nests of humble-bees."

Eichhoff (1866) found that *A. nigricornis* was nearly always present, and single specimens of *silaceus* and *pallens* occurred in *Bombus* nests.

Gorham (1869) captured *A. pallens* in a nest of *Bombus pratorum*.

Perris (1869-'70) took in the Pyrenees *A. nigricornis* attached to the antenna of a *B. montanus*.

Bugnion (1869-'70) took a *Bombus* in the Alps of Vaud, in August, 1866, which had an *A. pallens* attached to its proboscis.

Seidlitz (1869-'70) records the occurrence in a museum collection of three *Bombi*, each with an *Antherophagus* attached to an appendage.

In 1875 Perris published a description of the larva of *A. silaceus* taken from a nest of *B. sylvarum*.

Hoffer (1883), Fowler (1889), Sharpe (1899), Wagner (1907), Reitter (1911), Sladen (1912), and Reuter (1913), give brief notices, and Wagner published a figure of *A. nigricornis* attached to the bee's proboscis.

Of the North American *A. ochraceus*, Wheeler points out that Packard (1864) recorded its capture by Putnam in *Bombus* nests in Massachusetts and Vermont, and J. B. Smith (1909) noted its occurrence in *Bombus* nests.

Wheeler says that though possessed of well-developed wings and able to fly about and take up their position on flowers, *Antherophagus* does not seek out the *Bombus* nests, but compels the bee to carry it to the place in which its eggs and larvæ are developed, and quotes Sharp (1899): "We must presume that its senses and instincts permit it to recognise the bee, but do not suffice to enable it to find the bee's nest." Wheeler states: "The structure of the mandibles and the peculiar notch in the clypeus are clearly adaptations to firmly grasping the more or less cylindrical joints of the bee's appendages, and the red color of the integument and investment of golden-yellow hairs, so very suggestive of conditions in many myrmecophilous beetles, may account for the fact that the *Antherophagi* live unmolested in the *Bombus* nests."

Wheeler, after quoting the different views expressed by authors on the feeding habits of *Antherophagus* and its larvæ, concludes that the larvæ of these beetles are in all probability merely scavengers in the *Bombus* nests.

#### PHORESY.

I would attribute the case of the myrmecophilous mite *Laelaps equitans* to category (1). This species was described by Michael in 1891 from specimens taken by him in Italy in nests of *Tetramorium caespitum*. On 22nd April, 1907, I discovered it in a nest of the same ant situated under a large stone at Whitsand Bay, Cornwall. The mites were riding on the ants, and every now and then would jump off an ant, and spring on to another whilst in motion, with great agility after the manner of a circus-rider. This was again observed in the same locality on 17th April, 1909 (1910) and on Lundy Island 11th April, 1913. On July 9th this year, this mite was observed in a nest of the same ant at Porthcothan Bay, Cornwall. They were riding on the ants, resting on the heads or on the gasters of the porters; but on this occasion they were not seen to jump on and off, which led me to think they might belong to another species. The Rev. Hull, however, tells me they are *L. equitans* without doubt. Whether this difference in behaviour was on account of the day being dull without sunshine, or the time of year being later, I am unable to say. In every case, however, the mites were adults, and not immature forms.

*Laelaps oophilus*, which occurs with ants of the genus *Formica*, may be classed in the 5th category, when it nests on and among the egg masses of the ants. It is fed however when the ants lick their eggs (Syntrophy), and is of course carried about by the ants, when they move their packets of eggs. (This species was unfortunately recorded as *L. equitans* in 1902, from specimens taken by me on and among the egg-masses of *Formica rufa* at Oxshott and the Blean Woods in May, 1901.) Later in the year when the ants' eggs have hatched it may be found on the bodies of queen ants (1907), when it comes under the first category.

Beetles of the genus *Claviger* may also come under two classes. They are placed in the sixth category by Janet (1897) when they are carried by their hosts; but they might also be put in the second. The first specimen of *C. testaceus* taken in Britain was captured by Westwood in Oxfordshire in 1838, in a nest of *A. (C.) flavus*. It was attached to a winged ant (♂) on the underside. This, as pointed out by me in 1909, suggests a possible method of being taken out of the old nest to new ones.

The little blind beetle, *Leptinus testaceus*, is placed by Janet in the first category when lodged in the fur of little mammals to enable it to be carried to the nests of species of *Bombus*. Ruschkamp however (1919) who made a careful study of its habits, is doubtful if it should be considered a case of Phoresy or Ectoparasitism.

#### ANTHEROPHAGUS.

It may be suggested that the reason why *Antherophagi*, instead of seeking out the nests of *Bombi*, lie in wait for the bees which come to flowers and seize hold of them, thus compelling the latter to carry them to their nests, is not so much that they lack the instinct to find the

bees' nests, but rather that it gives them protection from their hosts when they arrive there. In the case of the permanent social parasitic ant, *Anergates atratulus* (1915), as shown by Crawley and myself in our experiments when introducing it into nests of its host, *Tetramorium caespitum*, the *Anergates* female seized hold of, and held firmly on to, the antenna of a *Tetramorium* worker; and as long as the grip was maintained, this action appeared to render it safe from the attacks of the owners of the nest. As with the ant, the beetle may thus obtain the nest "aura" of its hosts.

The notch in the clypeus of the *Antherophagus*, so well explained by Wheeler, reminds me of the notch in the clypeus of the slave-making ant *Formica sanguinea*. It has also been suggested that this is an adaptation to carrying the cocoons captured from the nests of the slave species.

I can add the following facts in connection with *Antherophagi* being found in Humble-bee nests, to those mentioned by Wheeler.

In 1896 and 1897 Tuck records finding specimens of *A. pallens* in nests of *B. agrorum*, *B. lapidarius*, and *B. sylvarum*, and *A. nigricornis* in nests of *B. latreillellus* and *B. terrestris*, in the Bury district, Suffolk.

In 1898 Bouskell when recording the capture of *A. nigricornis* on low parsnip blossoms, etc., in Buddon Wood, Leicestershire, remarks: "The fact of the beetle frequenting flowers like the fox-glove, infers a desire to be conveyed to the nest [of a *Bombus*], probably for the purpose of oviposition."

In 1900 Buckle took specimens of *A. nigricornis* in a nest of *B. terrestris* in the Foyle district in Ireland.

In August, 1904, I found a nest of *Bombus muscorum* near Lyndhurst in the New Forest. The comb was in a hollow in the ground and was covered over with bits of cut-up leaves and grass. On digging up the nest a specimen of *Antherophagus silaceus* was found in company with a number of *Cryptophagus setulosus* and a few other beetles.

On August 21st, 1906, I found larvæ of *Antherophagi* in a *Bombus* nest at Kingsclere. These were never recorded.

In 1909 Dollman and I dug up a nest of *Bombus muscorum* at Sandown, I. of Wight, in which a specimen of *A. pallens* was found. This was on August 15th, 1908, and the actual locality was the foot of "Limpet Run."

Cottam records in 1909 finding *A. pallens* and its larvæ in nests of *B. muscorum* in Derbyshire.

On August 28th, 1911, Dollman found a large nest of *B. hortorum* situated quite 3 ft. down in a large complex rabbit-burrow, and after digging it up with considerable difficulty captured a specimen of *A. pallens* in it.

In 1920 Scott in an interesting paper on some inhabitants of a nest of *B. derhamellus* received from Hoo near Rochester in 1918 records among other insects, the presence of three *Antherophagus* larvæ. Two of these he reared which proved to be *A. pallens*, and he gives some valuable notes and detailed observations on the pupation, etc. He was unfortunately unaware of Bold's records, and apparently of Wheeler's 1919 paper; as he credits Perris (1877) with the first observation on an *Antherophagus* clinging to a *Bombus*, and secondly

Trautman (1915), who recorded finding *A. nigricornis* on a living humble-bee.

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### New species and sub-species of S. American Lepidoptera.

By W. J. KAYE, F.E.S.

FAMILY HELICONIDAE.

*Heliconius xanthocles*, Sat., *flavosia*, sub-sp. nov.

Very like the figured form of *H. xanthocles* sub-sp. *cethosia*, Seitz (*Mac. Lep.* v. pl. 77a), from which it differs in that instead of having a discal patch of yellow beyond the cell it has it extending inwards and occupying about one-third of the cell area. The discocellular strongly black. Hindwing with the red rays only extending half-way across wing as in *cethosia*.

Habitat. E. Colombia, Villavicencia, Feb., 1919, ♂.

Susamuco, Sep., 1917, ♀.

Type from Villavicencia, in coll., Kaye.